AD-A139 084 SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY (SELECTED ARTICLES)(U) FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH D G QIAN ET AL. 14 FEB 84 1/1

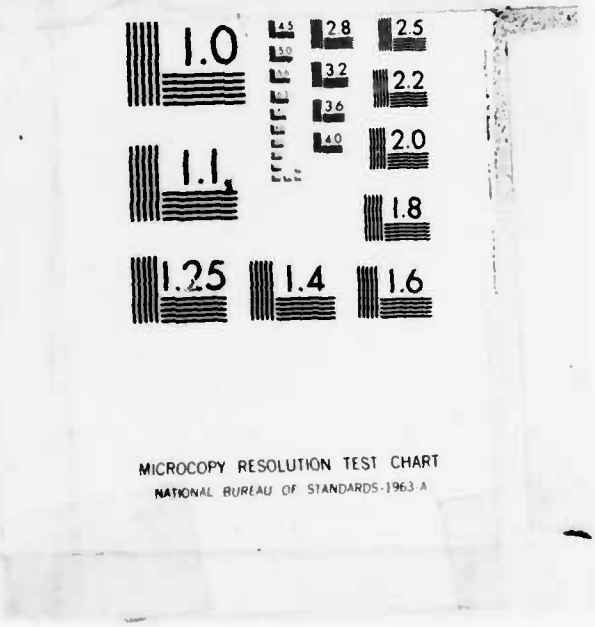
UNCLASSIFIED FTD-ID(RS)T-0006-84 F/G 5/1 NL

END

DATE FILMED

4-84

DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FTD-ID(RS)T-0006-84

FOREIGN TECHNOLOGY DIVISION

SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY

(Selected Articles)

Approved for public release; distribution unlimited.

84 03 15 119

EDITED TRANSLATION

FTD-ID(RS)T-0006-84 14 February 1984

MICROFICHE NR: FTD-84-C-000184

SCIENOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY
(Selected Articles)

English pages: 29

Source: Kexuexue Xu Kexue Jishu Guanli, Nr. 5, 1981, pp. 39-41; 42-44

Country of origin: China
Translated by: SCITRAN
F33657-81-D-0263
Requester: FTD/TQTM

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

Table of Contents

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

SCIENOLOGY

and management of science and technology

The leaders who make scientific decisions

On "coordination"

Agronomy - the science that dictates the modernization of agriculture

On the "departmental structure" of the scientific and technological ranks

Examination into the conditions of the responsibility system of the agricultural teams

Nobel - a leader who knows to use the right person for the right job

. Scientific and Technological Ranks .

On the "Departmental Structure" of the Scientific and Technological Ranks

Dai Guang Qian — Bureau of Scientific and Technological Cadres
The State Council

The adjustment of the economy includes two aspects; one is the reasonable reformation and merger of the economic structures and the other is the technological reformation of the old enterprises. Both of these aspects are closely related to the structure of the scientific and technological ranks. A reasonable economic structure requires a reasonable structure in the scientific and technological ranks. It is impossible to have a proper technological reformation without it.

The "Departmental Structure" of the Scientific and Technological Ranks

According to the report provided by the National Science Council to UNESCO, the scientific and technological ranks of our country consist of the following five categories: the Academia Sinica and its local branch systems; the various divisions of the State Council and their local scientific research and design agencies; the scientific research institutions of the high level schools and universities; the scientific and

technological ranks of the factories, mines, enterprises and farming villages; and the ranks who are involved in the scientific and technological development of the defense industry. The departmental structure of the scientific and technological ranks to be discussed in the present paper are not organized according to these five categories. Instead of using these categories, this paper takes the angle of the national economy and examines and classifies the structure of the scientific and technological ranks under various major sectors of the national economy. The main point here is to examine the problem of the quantitative structure of the engineering technical staffs under various major industrial sectors.

In 1978, the total number of the scientific and technological personnel affiliated with the units under the publicly owned systems is about 435 millions. The distributions are roughly as follows. The various types of scientific and technological personnel under the major categories of education and sanitation; agriculture, forestry, hydrology and meteorology; and industries represent 40.6%, 8.2% and 27.7% of the total number of the scientific and technological personnel throughout the country, respectively. This condition is consistent with the overall condition that our country is a major country with a population of 1 billion (has a basic need for the education and sanitation facilities), that agriculture is not advanced (lack of technical personnel in agriculture and forestry), and that

our country has already developed a considerable scope of industries.

Except for certain fixed numbers of people affiliated with the departments of basic construction, postal and electrical services, and transportation, more than half of the 157.1 million engineering technical personnel affiliated with units under the publicly owned systems in 1978 were concentrated in the industrial departments. The total number is 85.1 million. Among these only 14.5% were affiliated with light industries and heavy industries accounted for 85.5% of the personnel.

In additional to this, close to two thirds (64.2%) of the engineering technical personnel in the industrial departments were concentrated in the mechanical and metallurgical departments.

This "Departmental Structure" of the Scientific and Technological Ranks is not Suitable for the Need of the Adjustment of the National Economy

Over a long period of time, the economic development in our country has been on a track of a heavy structure. We stressed and gave preference to the development of the means of production and ignored the production of the consumers' goods. The means of production produced under this policy were "self-serving" and they just went around in circles within the heavy industries. The production and service of the consumers'

goods have been ignored. From 1949 to 1978, the heavy industries have grown by more than 90 times, the light industries by about 20 times and the agricultural industries by about two times. The development in the production of the means of production far exceeded the development in the production of comsumers' goods, hence produced an unbalanced development. The supply of goods was not enough to satisfy the demands in basic constructions, industrial production and marketing supplies.The problem was getting increasingly severe and produced serious wastes in both production and construction. The entire national economy could not function smoothly and the economic effect was very bad. If we were to allow this situation to persist over a long period of time, not only the peoples' quality of living can not be improved but also the production and construction will face many difficulties. The ultimate objective in adjusting the national economy is to make a reasonable reform in the economic structure according to the state of China. This adjustment will gradually shift our economic actions from passive to active and clears the way for the Chinese style modernization constructions. The goal now is to gradually adjust the production structure from a heavy type structure to a reasonable light type structure.

The production of the consumers' goods is a process which involves a synthesized processing procedure. A lot of scientific

fields and technological categories will be involved from the supply of the raw materials to their processing and production and ultimately to the packaging of the products. At the present time, the studies in science and technology in the light industries are not suitable for the development of the type of light industries which constitute a major part of the production of the consumers' goods. One important reason is that the number of scientific and technological staffs in the department of light industries is low and these people are not well suited for their jobs. From the point of view of the departmental structure of the scientific and technological ranks, we can say that the variation in the "heavy type structure" associated with the scientific and technological ranks is still not significant.

This situation makes the scientific and technological strength of the light industry weak at all areas, hence producing a sharp contradiction to the development in production at the present time. For example, the rating of the bicycles produced by the Beijing Bicycle Factory has been dropping

* Here we are referring to the large scope light industries. This is to say that we are including all industries which produce consumers' goods. In additional to the systems under the Department of Light Industries and the Department of Textile Industries, we are also including the parts of the other industrial departments which produce consumers' goods. For example, the electrical

meter produced by the First Mechanical Department, the part of the consumers' goods (television, semiconductor) produced by the Fourth Mechanical Department, the foods and clothing produced by the Commerce Department and part of the merchandise produced by the community enterprise under the Agriculture Department.

P.10

from year to year as judged by the bicycle industries in the country. The demand for production, however, has been increasing continuously. This particular factory has a total work force of 3350; among them only 34 are technical staff. Furthermore, there is not a single technical personnel specialized in the fields of lacquering, electroplating and welding. We can show another example here. The annual production of soda in Beijing is two million dozens and this supply is not enough to meet the demand. One of the reasons is that the only canning machine with relatively high efficiency is a machine shipped from Shanghai. This particular machine was made in the 1930's and it breaks down a lot. Sometimes the machine works and sometimes it doesn't. Attempts to repair this machine properly in the past have failed. According to second hand information, this machine is not fixed since there is a long standing technical problem concerning the pressure which can not be solved. We are encountering more technical problems in the development of the fast foods which can solve the meal problem on the way of the

new Long-March. No wonder the comrades in the Department of Light Industries say that even though we can send rockets to the sky and recover satellites, we still have to obtain a patent from foreigners for the production of the cover plates for the light type packages.

We can view this problem from another angle. We will have to reduce the production of certain industries in order to satisfy the requirements of the adjustment in the national economy. The primary industries in question are the industries which produce machinery. The secondary industries are the steel industries (a smaller scale of reduction). These two industrial departments are precisely the places where the scientific and technological staffs are most heavily concentrated. Associated with a change in the customers of the light industries there has already been a certain number of engineering technical personnel devoted to the various technological categories which involved light industries with more modern equipment, reformation of technology and production of products. Even though this is already happening, there is still a considerable number of leaders and technical personnel who feel that this is nothing more than a "temporary measure", not a permanent right course. This is why they do not put too much emphasis in obtaining more modern knowledge and advancing the level of science and technology in these areas. Due to these conditions, the heavy type structure of the scientific and technological ranks has not been changed very much in substance.

This situation deviates considerably from the requirement of the adjustment in the national economy. This deviation is especially significant when compared to the ultimate goal of the adjustment in the national economy.

The Reasons that Cause the "Departmental Structure" of the Scientific and Technological Ranks to be Incompatible with the National Economy at the Present Time

The most fundamental reason for the problems mentioned above to occur is that during the course of the development of the scientific and technological ranks in our country, we have already adapted to the requirement of a national economy which was developing toward a heavy type structure. This is no longer compatible with the adjustment in the national economy at the present time. This is actually a historical problem.

During the more than two decades of rule under the Kuomingtang before the liberation, there was only a total of less than one hundred and eighty thousand graduates from the high level schools. After these engineering technical personnel left schools the first thing they considered was to make a living. Many people were forced to abandoned their specialized technological training in order to have jobs. At that time the liberated territories still lacked any foundation for modern industries. At that time some specialized technical personnel

there took positions in other posts since work in other areas required a lot of revolutionary cadres. This is why on the eve of the liberation, our country has only fifty thousand scientific and technological personnel. No ranks could be formed at that time, let alone a reasonable structure.

After the liberation, starting from 1953 and 1954, our country began a large scale build up of the economy. This massive build up was centered anound the USSR-aided one hundred and fifty six projects. In order to insure the supply of the equipment and raw materials necessary for the development of the agricultural industry, the light industry, mass transit and transportation as well as the defense industry, we have given preference to the development of the heavy industries. This policy was absolutely necessary and correct. At that time, we have also observed a balanced development in the coal, petroleum, electric and transportation industries as well as the coordinated development of the heavy, light and agricultural industries. Corresponding to this policy, the engineering technical ranks grew from one hundred and thirty thousand in 1952 to close to a half million by the year 1957. Since the annual growth rate of the heavy industry was more than twice of that of the light industry, the formation of a heavy type structure in the engineering technical ranks was quite natural. Their distributions are shown in the table below:

TABLE

1. 一九五七年主要工业部门工程技术人员数

	2 总计	3 冶金	4 电力	5 煤炭	6 石油	7 化学	8 机械	9 建材	10 森林	11 食品	12 纺织缝纫皮革	13 造纸文教用品
14 工程技术人员数（万人）	15.7	2.1	0.8	1.4	0.2	1.1	6.9	0.5	0.4	0.6	2.3	0.4
15 占主要工业部门工程技术人员总数的%	100	12.5	4.8	8.4	1.2	6.6	41.3	3.0	2.4	3.6	13.8	2.4
16 轻重工业中所占比例粗分%	100	80.2									19.8	

Key: 1- The number of engineering technical personnel in various major industrial departments in 1957.

2- total; 3- metallurgy; 4- electric power; 5- coal; 6- petroleum; 7- chemistry; 8- mechanical; 9- construction material; 10- forestry; 11- food; 12- textile, tailoring and leather; 13- making paper and other products for educational purposes; 14- total number of the engineering technical personnel (in 10 thousands); 15- the % among the total number of the engineering technical personnel in the major industrial departments; 16- the rough % representing the fraction of the personnel in the light and in the heavy industries.

However, after the beginning of the second five-year project, we still over-emphasized the preferential development of the heavy industries. We even simplified the interpretation of the preferential development of the heavy industries as the preferential development in the steel industries. We arranged our national economy centered around the production of the steel. Having done this, the development in the agricultural and light industries were restricted and hampered. This also made the fuel power industries such as coal, elecgric and petroleum, the construction material industry and the transportation industry short lines in our national economy for a long period of time. The entire

national economy could not be developed smoothly under this kind of imbalance and tremendous difficulties occurred. During the second five year project, the rate of growth of the heavy industry was six times of that of the light industry. In order to adapt to this kind of a condition, the various levels of schools put emphasis on the needs of the heavy industries when they train the prospective engineering technical personnel. We can take the colleges of engineering among the high level schools as an example. During the years 1957 to 1962, the number of students majoring in metallurgy in the schools grew by an annual rate of 24.9% while the students majoring in light industries and agriculture grew by only an annual rate of 12.2%. Corresponded to this situation, the engineering technical personnel in the metallurgical industries grew at an annual rate of 18.9% white the growth rate for the textile industries was only 5.7%. Not only did the number of personnel in the light industries grow at a low rate, the specialized categories were also limited. Up until 1980, there were 453 specialized engineering fields under 15 categories in the colleges of engineering of the high level schools. The number of specialized fields which are directly related to the development of the light textile industries was only 46, representing 10.15% of all the specialized fields in the colleges of engineering. This is why the structure of the engineering technical ranks in the industrial departments became more and more heavy in nature under this kind of long term development.

Secondly, due to the influence of the "leftist" thoughts, educated people were treated erroneously. The combination of this and the malpractice in management gradually make the scientific and technological staffs virtually owned by the departments, the localities and the units. With this kind of confinement, these people can not go freely from one unit to another. These problem produce a kind of "rigid structure" in the departmental structure of the scientific and technological ranks. This is why even though the national economy has already begun its adjustment, the structure of the scientific and technological ranks is still dragging its feet in making reforms. Actually, at the early stage of the liberation, our system was not rigid. When the Korean War broke out in 1952, the Politburo of the central peoples' government decided to transfer one thousand technical staffs and close to four thousand technical workers specialized in the manufacture of navigational equipment, automobiles, and tanks from the various departments in the central government and the various major administrative areas in order to enhance the establishment of the defense industries. In 1953 when our country began a large scale build up in the economy, ≪Peoples' Daily≫ had published an editorial in ≪putting the specialized technological staffs in areas where they are most needed for the build up of the economy≫ . This particular editorial stressed " without a sufficient number of the specialized technical personnel, it is impossible to transform our country

from an agricultural country to an industrialized country". It pointed out the issue that the unreasonable useage of the specialized technical personnel has to be resolved. In the following year, the Politburo of the central peoples' government further decided on a national basis to register and record the improper useage of industrial technological cadres as well as the failure to match the job requirement with the training among all agencies above the level of county; among all publicly owned and joint publicly and privately owned enterprises; and among 14 specialized fields such as civil engineering, architecture, and electric engineering in all high level national schools. The purpose of this policy was to first concentrate all effort in solving the problem of the unreasonable useage of the industrial technical cadres within a relatively short period of time in order to adapt to the pressing requirement associated with the industrial build up at that time. After these people had been registered, they were gathered together within a deadline and sent to various posts associated with the major industrial constructions through an unified allocation system. These procedures were suitable to the requirement of the build up in the economy and reflected the fact that the structure of the scientific and technological ranks at that time was a very agile "flexible structure". It has been twenty years since that time and the scientific and technological ranks can no longer be

compared with those in the past. At the present time, the transfer of the scientific technical staffs is extremely difficult even among the scientific research, production and teaching divisions of the same unit, let alone the transfer of staffs among the different departments. It is an even more difficult business to arrange a well organized and well guided project for the heavy industries and the military industries to help and support the light industries. The proper adjustment of the national economy will be very difficult to achieve as long as these conditions persist.

The Several Problems that have to be Solved in order to Change the Departmental Structure of the Scientific and Technological Ranks and hence Make it Compatible with the Development of the National Economy

It is very difficult to change the departmental structure of the scientific and technological ranks since it was formed over a long period of time. This change is probably going to be even slower than the change in the economic structure. In order to be compatible with the development in the national economy, we should try to solve this problem from three areas. These three areas involve planning, measure and method.

In the long run, it is necessary for us to carefully examine the "departmental structure" of the scientific and technological ranks through an unified developmental planning

scheme which takes the national economy, science and technology, and the entire society into consideration. This examination should be done at the national, the provincial, the municipal as well as the local levels. This requires a coordinated study conducted by the governing departments in economy, education and science and technology. Any effort from a single department can not solve the problem.

Judging from the conditions at the present time, it is necessary for us to adopt some short-range measures in order to adapt to the requirement of the economic adjustment. To strengthen the scientific and technological ranks in light industries, the first thing we have to do is to vigorously train the reserve force. We need to realistically manage the existing high level schools in light industry and put emphasis on properly managing the specialized medium level technical schools. Secondly, we should appraise and decide technical levels for those workers who have gained a certain scientific and technological level through learning and practical experience. We should also select a part of them to strengthen the scientific research ranks. Thirdly, we should strengthen and elevate the scientific and technological ranks in the light industries by systematically transfering some technical man power from the heavy industries and the military industries, or adopt some feasible measures for arranging short term cooperation and adjunct positions, or to create a "undirectional

flow of knowledge" through various kinds of transfer in the technologies.

From the point of view of the scientific research, it is necessary to come up with the methodology for solving the problem in the structure of the scientific and technological ranks. At the present time, the most important thing is the establishment of the qualitative relationship equation between the structure of our national economy and the scientific and technological ranks. This equation is very important; it does not matter whether it is an empirical equation or not. We also need to determine the reasonable qualitative parameters associated with this equation. This equation will be an important foundation for establishing policies and planning schemes. From a microscopic point of view in the past, such as establishing a new enterprise, the parameters which reflected the determination of the work force generally depended upon items such as the size of the enterprise and the difficulty of the technology involved (such as the guide line proposed by the Department of Textile Industry in 1963 which specified that there should be 22.2 technical staffs per each ten thousand spindles for the cotton textile industry and there should be 57 workers per each one hundred looms for the hemp textile industry). From a macroscopic point of view, the Office of the Planning Task Force of the Central Scientific and Technological Cadres

Department has carefully examined the relationship among the engineering technical cadres , production of industry as well as the rate of growth of the workers for our country during the years 1953 to 1959 and for the USSR during the years 1926 to 1936. This study was conducted in 1960 and the objective was to determine the requirement of the planning scheme for the development of the scientific and technological ranks. The preliminary conclusions of this study were: for each 100 % increase in the production of the industry, there should be an 90% increase in the engineering technical cadres, an 40% increase in the staffs and an 50% increase in the production workers in order to insure a proper growth in the industry. These parameters are still the most relatively clear-cut parameters available to date.

We should find the method and establish the mathematical model through our own research. In this way, the analysis into the departmental structure of the scientific and technological ranks in our country will be a lot more scientific.

(Editor : Ke Ren)

An Analysis of the Structure of the Scientific and Technological Ranks in the Chemical Engineering Industry

Bureau of Science and Technology — Wu Shi Min
Department of Chemical Engineering — He Sheng

One of the most important missions in the management of science and technology is the optimization of the scientific and technological ranks.

We have recently conducted a preliminary examination and analysis concerning the structural conditions of a part of the scientific research units directly under the Department of Chemical Engineering. We will now introduce some of our opinions concerning the related problems here so they can be examined by all concerned.

I. The ratio between the scientific research personnel and the auxiliary supporting personnel

The ratio between the scientific research personnel and the auxiliary supporting personnel reflects to a certain extent the degree of efficiency of the scientific research personnel. Even though the scientific research personnel are the main participators in the scientific research activities, their usefulness can not be fully achieved without the coordination of a certain number of the auxiliary supporting personnel. According to the researches done abroad, by properly staffing the auxiliary supporting personnel to the scientic research

personnel, the unreasonable time consumption can be reduced by 30 ~ 40%. The final products of these properly staffed scientists will be 50 ~ 75% higher than the scientists without the auxiliary supporting staffs. This is why that within the domain of chemical research in the United States, the ratio between the scientific research personnel and the auxiliary supporting personnel is roughly 1:2.5. This ratio for the USSR is 1:3.

The systems of scientific research and management in our country are different from those in the foreign countries. There is also a difference between the scientific research units under the industrial departments and the units under the Academia Sinica. In order to facilitate the comparison and discussion, we have combined the personnel in the scientific research units under the chemical engineering system into three categories according to the related conditions both within our country and abroad:

The first type is the scientific research personnel. These are the technical staffs who are directly involved in the scientific research activities.

The second type is the auxiliary supporting personnel. This type includes the management, repair, instrumentation, information and graphics personnel who directly support the scientific research activities. Experimental workers are also included in this type.

The third type is the logistics personnel. This type includes the administrative management as well as the rear-service personnel.

Table 1 below shows the structural conditions of a part of the scientific research units under the Department of Chemical Engineering with a total work force of more than 1000.

TABLE 1

表一

1 单位	2 职工总数	3 科研人员		6 辅助人员		9 服务人员	10 科研人员与实验工人的比例	11 科研人员与辅助人员的比例
		4 人数	5 占职工总数%	7 人数	8 其中：实验工人数			
1	3460	680	20	1620	860	1150	1:1.3	1:2.3
2	1790	590	33	830	480	370	1:0.8	1:1.4
3	1530	520	34	670	280	340	1:0.5	1:1.3
4	1480	250	18	420	120	810	1:0.5	1:1.7
5	1360	450	33	740	420	170	1:0.9	1:1.6
6	1080	360	34	450	220	270	1:0.6	1:1.3
12 合计	10700	2850	29	4730	2380	3120	1:0.8	1:1.6

Key: 1- Unit; 2- total number of staff and worker; 3- scientific research personnel; 4- number; 5- % among all staff and worker; 6- auxiliary supporting personnel; 7- number; 8- among them: number of experimental workers; 9- service personnel; 10- ratio between the scientific research personnel and the experimental workers; 11- ratio between the scientific research personnel and the auxiliary supporting personnel; 12- total count

From Table 1 we can observe two problems:

First, the mean ratio between the research personnel and the experimental workers is 1:0.8. This shows that the relative fraction of the experimental workers is too small. Due to this lack of sufficient experimental workers, the scientific research personnel will have to spend a lot of time and energy doing things that are supposed to be done by the auxiliary personnel. This is true because the experimental workers are the supporting personnel for those who are involved directly

with the scientific research activities. According to a survey, a lot of the scientific research personnel in some units spend 1/3 of their time as operating workers. Judging from this, it is necessary to systematically train and replenish the experimental workers for the front line of the scientific researches.

Second, the scientific research personnel accounts for about 1/3 of the total work force. The ratio between the main stream scientific research personnel and the auxiliary scientific personnel is only 1:1.6 (it is 1: 2～3 abroad).One of the important reasons for the existence of such a conflicting condition is the "small but complete" concept formed over a long period of time. In foreign countries, the supplies of scientific equipment as well as the living logistics have been socialized. In our country, however, all these problems are the responsibilities of the scientific research units. Due to this , a lot of the scientific research units will have to devote a considerable amount of man power to do these jobs. Some units even devote from 1/3 to 1/2 of the total work force for this purpose. In order to change this kind of a condition, the first thing to do is to break the "small but complete" situation. We can then gradually move down the road of socializing the supply of scientific equipment and living logistics. Secondary to this measure, we should realize that it is inappropriate to set up production work shops that are not related to scientific research in a scientific research institution. The main route for increased

income should be through transfer of scientific research results with compensation or reward. Furthermore, we should try to streamline the organizations and gradually and systematically transfer the administrative management personnel into the areas of scientific management.

II. The allocation of the specialized scientific research personnel

The scientific research at the present time requires increasingly more coordination from many different scientific and specialized fields. This is why that the formation of a scientific research team has to take the requirements of the various stages of the research into consideration. These stages are the basic research, the applied research and the developmental research. Proper ratios among the various types of specialized personnel have to be maintained. For those units specialized in industrial scienticfic research, it is even more important to supply them with a proper fraction of the engineering research personnel.

Table 2 shows the formation of the specialized scientific research personnel in the U.S. Du Pont Company, the U.S. Dow Chemical Company and a part of the scientific research units directly under the Department of Chemical Engineering in our country.

TABLE 2

1 单位 / 2 专业	3 杜邦公司		6 道化学公司		9 我国化工部部分直属院所	
	4 人数	5 比重%	7 人数	8 比重%	10 人数	11 比重%
12 研究人员数	3796	100	2000	100	4110	100
13 其中：各种化学人员	2111	55.6	868	43.4	2378	57.9
14 化学工程人员	822	21.8	503	25.3	369	9.0
15 机械工程人员	468	12.2			468	11.4
16 物理、数学人员	200	6.0	63	3.1	56	1.4

Key: 1- Units; 2- specialized field; 3- DuPont Company; 4- number of people; 5- fractional percentage %; 6- Dow Chemical Company; 7- number of people; 8- fractional percentage%; 9- institutions directly under the Department of Chemical Engineering of our country; 10- number of people; 11- fractional percentage %; 12- number of research personnel; 13- among them: various kinds of chemical personnel; 14- chemical engineering personnel; 15- mechanical engineering personnel; 16- physics, mathematics personnel.

We can see from Table 2 that the fractional percentages of the specialized engineering personnel are relatively large among the research staffs in the DuPont Company and the Dow Chemical Company. They constitute about 34% and 25.3% of the total research personnel in these two companies, respectively. Within the scientific institutions directly under the Department of Chemical Engineering of our country, the chemical engineering personnel accounts for only 9%. Even after we add the mechanical engineering personnel the percentage is still only 20.4%, about 5 ∿ 15% less than that in the foreign country. As far as the

physics and mathematics personnel are concerned, their fractional percentages are 2 to 4 times lower than those in the two companies. The lack of engineering personnel, especially the chemical engineering personnel, is due to the lack of engineering concept in our industrial scientific research institutions. This problem makes our scientific research remain in the stage of "specimens, exhibits, and gifts" very often and this is one of the major reasons that we can not industrialize our system very quickly. Similarly, the lack of personnel in specialized fields such as physics and mathematics is one of the major reasons that causes the scientific research level in our country to be low since many industrial scientific research institutions are not capable of conducting applied and basic research projects.

Based on these facts, we believe that we should try to appropriately increase the new specialized fields in the high level colleges and universities and beef up the training of the specialized industrial personnel. We should also allow the scientific research institutions to have preference in selecting the graduates from the schools. Secondly, we should systematically train a group of people who are originally participating in technological research so that they can participate in the engineering research. Thirdly, we should vigorously promote the ccoperation or joint venture between the high level schools and the factories. By fully utilizing their individual strong points, we can gradually form a science-technology-production integrated system.

III. The ratios between the high level, the medium level and the low level research personnel

In foreign countries, the structure of the high level, the medium level and the low level research personnel among the scientific and technological ranks has a "pyramid shape". This type of structure reflects in a good way the successive nature among the various levels of the research personnel and the orderly ascending principle. This also reflects the fact that the high and medium level research personnel are the backbones of the scientific research activities.

The structure of the high, medium and low level technical personnel in the scientific research institutions directly under the Department of Chemical Engineering of our country forms a "drum shape". In other words, large on both ends but small in the middle. The concrete ratios are shown in Table 3.

Table 3. (Page 26)

1. total number of research personnel 2. high level research personnel 3. number of people 4. relative weight %
5. medium level research personnel 6. number of people
7. relative weight % 8. low level research personnel
9. number of people 10. relative weight %
11. Note: according to the actual condition in the industrial scientific research institution, the high level research personnel in this table represents high level engineer; the medium level research personnel represents engineer; the low level research personnel represents assistant engineer and technician.

Table 3.

表三

研究人员总数	高级研究人员		中级研究人员		初级研究人员	
	人数	比重%	人数	比重%	人数	比重%
4110	53	1.3	2441	59	1620	39.7

From the above table we can see that the relative weight of the high level research personnel is too small for the scientific research institutions within the chemical engineering system. At the present time, most of the 16 major trades in chemical engineering have not established their technological authorities and leaders in scientific fields. Furthermore, most high level research personnel are placed in leadership positions, they have to hold more than one posts concurrently and are tangled up in administrative affairs. They are thus being kept away from practicing scientific research and can not fully realize their technical specialities.

On the other hand, this kind of a structural ratio reflects the situation in which the medium level research personnel are over concentrated in a research laboratory or even a special topic research team. Since most scientific personnel want to develop new ideas and want to accomplish things by themselves, the over concentration of the same level research personnel will naturally limit the full utilization of their knowledge and wisdom.

We feel that we should take effective measures to untangle the high level research personnel from the administrative

affairs as soon as possible. They should return to the first line of scientific research and provide technical guidance, assistance and transfer. In the same time, we should accelerate the process of training and selecting top technical personnel and hence produce a group of people who will become the leaders in scientific fields and specialized fields. In addition to these measures, we should be firm in our policy concerning the transfer of personnel. We should transfer the medium level research personnel from where they are over concentrated to the departments where they in short supply. This procedure will fully utilize their capability and enhance their growth and development.

IV. The age structure of the scientific research personnel

The age structure of the scientific research personnel reflects the creative vitality as well as the trend towards success of this scientific and technological team.

96% of the research personnel in the scientific research institutions directly under the Department of Chemical Engineering are trained by the new China. Due to the 10 years of catastrophe, however, this team has shown signs of aging and signs of a temporary shortage of man power. Table 4 shows the age distribution of the scientific research personnel in these institutions.

Table 4. (Page 28)

1. age interval 2. under 35 3. over 60 4. percentage

Table 4.

1. 年龄区间	2 35岁以下	36—45	46—55	56—60	3 60岁以上
4 百分比	14	62	20	3	1

From this table we can see that:

First, there is 62% of the middle age research personnel who are in the optimum age interval (age 35 - 45). They have gone through a systematic education in basic knowledge and they also have ten to twenty years of training. They have a certain capability of handling practical works. At the present time, they have become the main power behind the scientific research activities in the various institutions. However, they did not have the chance of obtaining any retaining concerning their trades so they lack modern scientific and technological information. This is why that whether we are talking about the development of the technical work at the present time or ten years from now, it is necessary to place the emphasis on training the middle age scientific research personnel since they represent the backbone of the fields. Needless to say, this is extremely important.

Second, we can also see from this table that the relative weight of young research personnel is very small, only about 14%. According to our estimation, if we were to replace 5% of the present research personnel by the newly graduated people each year starting from 1981, the mean age of this team will

still increase from 42 at the present to 44 ten years from now. The personnel who are in the optimum age interval will decrease from 60% at the present to 20%. This is why on the one hand we should speed up the process for training new personnel, and on the other hand we should create conditions in learning, work, and living for the young and middle age research personnel so that they can prolong their scientific usefulness for as long as possible.

(Edited: Chen De Yuan Graphics: Lou ling Ru)


DATE
ILME

country.